

HEALTH

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ENNERDALE RURAL DISTRICT

ANNUAL REPORT

OF THE

MEDICAL OFFICER OF HEALTH

1957

AND REPORT OF THE

CHIEF PUBLIC HEALTH

INSPECTOR



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ENNERDALE RURAL DISTRICT COUNCIL
HEALTH AND HOUSING COMMITTEE
1957-58

Chairman :

Councillor J. NOCTOR.

Member ex-officio :

The Chairman of the Council—Councillor J. COOK.

Members :

Councillors: G. S. BELL, F. B. BENSON, Rev. A. W. BINNS,
H. J. BRANNEY, G. FARRAN, J. E. HIGH, B.
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ROGERS, B. SMITH, A. THRELFELL.

HEALTH DEPARTMENT STAFF

Medical Officer of Health :

J. N. DOBSON, M.B., CH.B., D.P.H.

Chief Public Health Inspector :

*†‡ J. BUTTERY.

Additional Public Health Inspector :

*† R. M. HOWELLS.

Clerk :

Miss I. DAVIDSON.

(Joint Appointment with Whitehaven Borough).

Clerk-Typist :

Miss I. G. BENN.

*Public Health Inspector's Certificate Royal Society of Health.

†Certificate of Meat and other Food Royal Society of Health.

‡Certificate in Sanitary Science as applied to Buildings and
Public Works.

*Health Department,
53, Duke Street,
Whitehaven.*

To the Chairman and Members of the
Ennerdale Rural District Council.

Mr. Chairman, Councillor Mrs. McPoland and Gentlemen,

The influence of housing on the health of the district received mention in the annual report for 1956. The Housing Returns for the County of Cumberland for 1957 credited Ennerdale Rural District with an estimated 1,539 unfit houses, more than any other authority in the County, and this remains the outstanding health problem. Differing standards as to degree of unfitness mean that comparisons with other authorities must be made with caution, even so it is plain that a formidable task of slum clearance lies ahead.

No appreciable progress can be made with this problem until the shortage of staff is relieved.

In this report the practice of quoting the results of water samples has been resumed after a lapse of some years. Those from Meadley reservoir are rarely satisfactory and it is to be hoped that transfer of the water undertaking to the new Joint Water Board will not result in undue delay in the replacement of Meadley by the proposed Nannycatch reservoir.

In spite of these shortcomings the vital statistics for the year are uniformly good, showing a high birth and low infant mortality rate, and the lowest general death rate so far recorded. This year of good health was not seriously marred by the epidemic of Asian influenza which occurred in the early Autumn. It was marked however by the occurrence of the Windscale accident. This has been so completely documented that it may seem superfluous to give it more than passing mention. If, in fact, one wishes to review the events that took place and their consequences it is difficult to do so without reference to numerous sources. Accordingly a somewhat extensive account of this unique incident has been placed on record. This was prepared before the permanent closure of Pile No. 2 was announced, and should be viewed in that light.

Once again my duties have been lightened by the goodwill of Members of the Council. It gives me much pleasure to acknowledge both this and the help given me by fellow members of the staff.

I am, Mr. Chairman, Madam and Gentlemen,

Your obedient Servant,

J. N. Dobson,

Medical Officer of Health.

SECTION A.

STATISTICAL SUMMARY

I.—General Statistics

Area of Rural District in acres	...	...	...	88,730
Population (Registrar-General's estimate, mid-year, 1957)	...	...	...	28,950
Persons per acre	...	...	...	0.33
Number of inhabited houses, 1957-1958, according to rate books	...	...	...	9,031
Rateable Value	...	...	...	£199,420

VITAL STATISTICS

Births:—

(a) Live Births	Males	Females	Total
Legitimate	315	265	580
Illegitimate	14	14	28
Total	329	279	608

Crude Birth Rate per 1,000 of population ... 21.0

Adjusted Birth Rate ... 21.2

(b) Still Births	Males	Females	Total
Legitimate	7	8	15
Illegitimate	—	1	1
Total	7	9	16

Still Birth Rate (per 1,000 total births) ... 25.6

Deaths:—

	Males	Females	Total
Deaths (all ages)	162	124	286
Crude Death Rate per 1,000 of population	...	...	9.9
Adjusted Death Rate	...	...	11.9

Deaths from Pregnancy, Childbirth and Abortion ... 2

Death Rate of Infants under 1 Year of Age

All Infants per 1,000 live births	26.3
Legitimate Infants per 1,000 legitimate live births	25.8
Illegitimate Infants per 1,000 illegitimate live births	35.7

The following table is given for comparison of certain vital statistics.

TABLE 1.

	Birth Rate	Death Rate	Infant Mortality Rate
Ennerdale R.D.	21.0	9.9	26.3
Cumberland (Administrative County) ...	17.9	12.1	26.4
England and Wales	16.1	11.5	23.0

Table 1 summarises the basic figures for the year which are highly satisfactory. A higher birth rate is accompanied by a lower infant mortality, while the general death rate is the lowest on record. The increased birth rate continues the trend remarked last year, details of which are given in Table 2.

TABLE 2.

Year	Number of Births		Birth Rate per 1,000 of population:	
			Ennerdale R.D.	England & Wales
1953	...	504	19.4	15.5
1954	..	503	18.0	15.2
1955	...	525	18.6	15.0
1956	..	557	19.7	15.6
1957	...	608	21.2	16.1

Table 3 shows death rates over the past five years.

TABLE 3.

Year	Number of Deaths		Death Rate per 1,000 of population:	
			Ennerdale R.D.	England & Wales
1953	...	341	12.8	11.4
1954	...	336	13.1	11.3
1955	...	316	12.3	11.7
1956	...	335	14.0	11.7
1957	...	286	11.9	11.5

When the population is relatively small one must be cautious in drawing conclusions from single items unless a trend is consistently maintained. For example, no special significance is attributed to the fact that there were eleven deaths from cancer of the stomach in women compared with only one the previous year. Nevertheless it must be noted that the reduced general death rate is principally due to fewer deaths from diseases of the heart and blood vessels and respiratory diseases, total cancer deaths remaining about the same. Accidental deaths numbered thirteen, of which only three were the result of motor accidents. Unhappily there were two maternal deaths, the first to occur since 1949.

Infant mortality rates are given in Table 4 and cause of deaths in Table 5.

TABLE 4.

Year		Number of Infant Deaths		Death Rate per 1,000 live births:	
				Ennerdale R.D.	England & Wales
1953	...	...	13	26	27
1954	...	...	18	36	26
1955	...	...	20	38	25
1956	...	...	16	29	24
1957	...	...	16	26	23

TABLE 5.
Deaths of Infants Under 1 Year of Age

Cause of Death	Age in Weeks				Age in Months				Totals
	0-	1-	2-	3-	1-	3-	6-	9-	
Prematurity	3	—	—	—	—	—	—	—	3
Congenital malformations	3	—	1	—	1	—	—	—	5
Broncho-pneumonia	1	—	—	—	2	—	1	1	5
Aspiration pneumonia	1	—	—	—	—	—	—	—	1
Birth injury	1	—	—	—	—	—	—	—	1
Intra-cranial venous sinus thrombosis	—	—	—	—	1	—	—	—	1
Total deaths									
	Under 1 month 10				Over 1 month 6				16

There were eight male and eight female infant deaths, Of these sixteen, one had been born illegitimate. At 26 deaths per 1,000 live births, the infant mortality rate equals the record low figure of 1953. Indeed, that year and 1956, are the only years in which the rate has fallen below 30. These figures are very satisfactory. Had Ennerdale R.D. experienced the infant mortality of England and Wales, there would have been more deaths from prematurity and congenital malformations.

Cancer Mortality

There were 50 deaths from cancer, the primary sites of the lesions being shown in Table 6, while in Table 7 are given death rates for the Rural District and England and Wales.

TABLE 6.

Location of Disease				Male	Female	Total
Maxilla	...	...	...	I	—	I
Stomach	...	...	...	5	II	16
Colon	...	...	...	I	2	3
Rectum	...	...	...	2	I	3
Pancreas	...	...	...	I	—	I
Liver	...	...	...	I	I	2
Lung and Bronchus	...	...	...	II	—	II
Uterus	...	...	...	—	2	2
Vulva	...	...	...	—	I	I
Bladder	...	...	...	2	I	3
Prostate	...	...	...	2	—	2
Other sites	...	...	...	2	3	5
				28	22	50

TABLE 7.

Year	Number of Deaths		Annual Death Rate per 1,000 of population:	
			Ennerdale R.D.	England & Wales
1953	...	53	1.87	1.99
1954	...	44	1.54	2.04
1955	...	60	2.09	2.06
1956	...	51	1.76	2.07
1957	...	50	1.73	2.09

Table 7 shows with fair consistency that there is less chance of dying from cancer in the District than in most parts of England and Wales. Deaths from cancer of the lung and bronchus have increased, however, and are the highest since 1950, when deaths from this cause were first listed separately in the medical officer's report.

This is a situation which bears close watching. Throughout the country deaths from cancer of the lung associated with tobacco smoking continue to rise at an alarming rate. In addition to this influence there is the effect of sidero-silicosis amongst iron ore miners in the area. Doctors J. S. Faulds and M. J. Stewart concluded in their (1956) investigation of 180 post-mortem examinations made over a lengthy period that this condition predisposes to lung cancer, though neither silica nor ferric oxide is a specific carcinogen. They believe that non-specific chronic irritation is a factor. There seems to be an increase in the number of iron ore miners and ex-miners developing cancer of the lung, probably a legacy from the days before dust-suppressive measures were introduced into the iron ore mines. Investigations into the relationship of iron ore mining to cancer of the lung continue.

TABLE 8.

CAUSES OF DEATH DURING THE YEAR 1957

Registrar-General's Classification

	Males	Females
Tuberculosis of Respiratory System ...	2	2
Other Tuberculous Diseases ...	1	—
Syphilitic Disease ...	—	—
Diphtheria ...	—	—
Whooping Cough ...	—	—
Meningococcal infections ...	—	—
Acute Poliomyelitis ...	—	—
Measles ...	—	—
Other infective and parasitic diseases ...	—	2
Malignant neoplasm, stomach ...	5	11
Malignant neoplasm, lung and bronchus	11	—
Malignant neoplasm, breast ...	—	—
Malignant neoplasm, uterus ...	—	2
Other malignant and lymphatic neoplasms	12	9
Leukaemia, aleukaemia ...	—	—
Diabetes ...	—	1
Vascular lesions of nervous system ...	17	25
Coronary disease, angina ...	31	16
Hypertension with heart disease ...	3	3
Other heart disease ...	7	13
Other circulatory disease ...	5	4
Influenza ...	4	1
Pneumonia ...	6	7
Bronchitis ...	8	1
Other diseases of respiratory system ...	3	1
Ulcer of stomach and duodenum ...	—	—
Gastritis, enteritis and diarrhoea ...	—	1
Nephritis and nephrosis ...	4	1
Hyperplasia of prostate ...	3	—
Pregnancy, childbirth, abortion ...	2	2
Congenital malformations ...	4	1
Other defined and ill-defined diseases ...	23	17
Motor vehicle accidents ...	3	—
All other accidents ...	6	4
Suicide ...	2	—
Homicide and operations of war ...	—	—
Total (all causes) ...	162	124

SECTION B

GENERAL PROVISION OF HEALTH SERVICES

(a) Staff

There were no changes in staff during the year.

(b) Laboratory Facilities

Full use is made of the bacteriological facilities at Whitehaven Hospital under the direction of Dr. A. C. F. Ogilvie, and of the Public Health Laboratory Service at the Cumberland Infirmary directed by Dr. D. G. Davies. Analytical services are provided by Mr. C. J. H. Stock, of the County Analyst's Office, Darlington.

(c) Local Health Authority Services

Medical services provided under Part III of the National Health Service Act are the responsibility of the Cumberland County Council. Information about the provision of Home Nursing, Home Helps, Immunisation and other services is available at the office of the Senior Assistant County Medical Officer, 102, Scotch Street, Whitehaven.

Clinics are held as follows:—

	Frizington	Cleator Moor	Egremont
School Clinic ...	Mon. 9-30 a.m.	Thurs. 9-30 a.m.	Thurs. 9-30 a.m.
Child Welfare ..	Mon. 2-00 p.m.	Thurs. 2-00 p.m.	Thurs. 2-00 p.m.
Ante-Natal ...	Wed. 2-00 p.m.		
Dental ...	Tues. 9-30 a.m.	Wed. 2-00 p.m.	Mon. 9-30 a.m.

A number of ante-natal clinics are conducted by general practitioners in conjunction with the district midwife.

Appointments may be made through the School Clinics for attendance at the following special clinics:—

Ophthalmic, Ear, Nose and Throat, Orthopaedic, at Sandhills Lane Clinic, Whitehaven.

Child Guidance, at 10, Scotch Street, Whitehaven.

Speech Therapy, at Cleator Moor and Egremont Clinics.

Orthoptic treatment at Whitehaven Hospital.

The Occupation Centre, Flatt Walks, has 40 places for mentally backward children.

(d) Hospital Services

Facilities provided by the Regional Hospital Board include Whitehaven Hospital, Flatt Walks: 119 beds. General hospital services. General practitioners have X-ray facilities directly available.

Homewood Annexe has 41 beds for tuberculosis and diseases of the chest.

The Hollins, Hensingham: 31 beds. Pre-convalescent and chronic sick, with a small number of ante-natal beds.

Galemire, Cleator Moor: Infectious diseases hospital with 24 beds, 12 of them for tuberculosis.

The Chest Clinic serving the area is in St. Bridget's Lane, Egremont.

Part III hospital accommodation is available in Meadow View House, Whitehaven (31 beds), by joint user agreement with Cumberland County Council.

(e) National Assistance Acts

On a report from the police that an old lady in Cleator Moor had not been seen for three days and was believed to be in distress, a house was entered on 21st January.

She was found sitting helplessly in a broken chair, dressed in filthy clothing and covered with an old coat. There was neither light nor heating, and the little food there was she could not reach owing to weakness and severely ulcerated legs. She was surrounded by rubbish and spilt coal.

Nevertheless, she refused to be taken to hospital and this had to be accomplished by getting a magistrate's order that evening. Despite hospital care she died on 6th February. She had, however, settled very well and her last days were contented.

SECTION C

SANITARY CIRCUMSTANCES OF THE AREA

A report by the Public Health Inspector on the work of the year has been submitted and will be found at the end of this report.

During the year, water distribution to the coastal strip was improved by the completion of a 4" main from St. Bees Stone to Howman and thence to St. Bees and Coulderton.

Complaints of lack of water^r at Distington followed the coming into use of Distington Creamery with consequent increased demand. The situation was met by the fitting of a pressure-retaining valve to the Creamery supply and erecting a booster pump at Dean Moor in June to improve the supply from Owson Fell. From that time the Gilgarran tank, Boonwood and Watch Hill reservoirs have been maintained at a satisfactory level.

SECTION D

PREVALENCE OF, AND CONTROL OVER, INFECTIOUS DISEASES

Notifications, other than those of tuberculosis, are shown in Table 9.

TABLE 9.

Disease					No. of cases notified	Admitted to Hospital	Died
Scarlet Fever	...	...	..	...	2	—	—
Puerperal pyrexia	...	...	...	...	2	—	—
Acute primary pneumonia	...	...	...	...	18	4	1
Erysipelas	...	...	...	...	1	—	—
Cerebro-spinal meningitis	...	...	...	...	1	1	—
Poliomyelitis, paralytic	...	...	...	...	—	—	—
„ non-paralytic	...	...	...	...	—	—	—
Measles	...	...	...	...	365	3	—
Whooping Cough	...	...	...	...	105	3	—
Dysentery	...	...	...	...	14	—	—

The Table shows remarkable freedom from notified disease of consequence. What it does not show is the non-notifiable influenza which spread in epidemic form under the name of Asian 'flu, an infection originating in the Far East and striking almost every country in turn.

Generally it was a mild condition with a low death rate; in contrast to other epidemics people over 60 did not suffer heavily. The number of deaths in England and Wales paralleled those occurring in the influenza epidemic of 1953, and were less than half of those in that of 1951.

Post-mortem examinations showed that most fatal cases had tracheo-bronchitis and pneumonia, with infection by *Staphylococcus Aureus* in 60-70%. Other organisms with or without staphylococci were found in a further 5-16%. Influenza virus was found in 80% of those dying within five days of the onset of the disease. The bacteriologists of the Public Health Laboratory Service considered that the virus itself caused death particularly in those cases, whereas secondary infection was mainly responsible for later deaths.

Only three deaths were certified as being due to influenza or influenzal pneumonia in the Rural District, where the epidemic started in mid-September. Nevertheless, influenza caused much sickness and inconvenience, not to mention several weeks of very hard work for the general practitioners. Industry was not too seriously affected, though absenteeism due to sickness reached 20% among iron ore miners and 24%

in a clothing factory. Schools were affected much more, and in advance of factories. Absences up to 45% of scholars on roll were common, and at Moor Row school reached 66%.

The County Council offered immunisation to certain groups of doctors, nurses and others specially exposed to infection, but did not receive the necessary vaccine till the epidemic was well under way. What contribution this made to keeping the health services going is not very clear. It is of course extremely difficult to manufacture, test and supply, adequate quantities of vaccine specific for one variety of influenza in the face of a pandemic sweeping rapidly from one country to another, and the attempt at protection was praiseworthy.

TUBERCULOSIS

Notifications in 1957 were received as follows:—

TABLE 10.

			Respiratory	Non-Respiratory	Total
Male	...	...	20	1	21
Female	...	...	20	4	24
			—	—	—
Total	...	...	40	5	45
			—	—	—

Total notifications are only two-thirds of those received last year. Comparison of the age-incidence table given below with that of 1956 shows fewer cases in every age group, but the principal improvement, in contrast to expectations, occurred in the males over 55.

TABLE 11.

Age in years		9-	15-	35-	55-	Total
Male	...	3	5	6	6	20
Female	...	4	9	3	4	20
Total	...	7	14	9	10	40

Deaths from Tuberculosis (Rates per 1,000).

TABLE 12.

Year	Respiratory Tuberculosis Ennerdale		Tuberculosis England & Wales		All forms of Tuberculosis Ennerdale		Tuberculosis England & Wales	
	No. of Deaths	Death Rate	No. of Deaths	Death Rate	No. of Deaths	Death Rate	No. of Deaths	Death Rate
1953	12	0.42	0.18	...	13	0.46	0.20	
1954	8	0.28	0.16	...	10	0.35	0.18	
1955	6	0.21	0.13	...	7	0.24	0.15	
1956	5	0.17	0.11	...	6	0.21	0.12	
1957	4	0.14	0.095	...	5	0.17	0.11	

Continuing reduction in the death rate from tuberculosis is again evident. Though there is still scope for improvement, the **rate** of decline in tuberculosis mortality is considerably better than that occurring in the country as a whole in recent years. However, of the cases notified in West Cumberland in 1957 Dr. Hambridge, Consultant Chest Physician, remarks that the largest proportion of infectious cases were found in the Rural District and there is clearly no room for complacency. Treatment facilities improved during the year with the opening of 41 beds in small ward units in the Homewood Annexe. It is now rarely necessary for local people to be treated in the so-called remote institutions.

Mass X-Ray**TABLE 13.**

Year	1952	1953	1954	1955	1956	1957	Total
Number X-rayed	1,918	2,382	4,303	3,950	3,807	2,661	19,531
New active cases discovered							
by X-ray	19	24	29	18	12	8	110
Notifications during year	58	61	72	71	64	40	366

Table 13 records the work done by the Mass X-ray Unit. The number of new active cases discovered, though smaller than ever before, approximates to three per 1,000 examinations, which is a rate representing "value for money". For West Cumberland as a whole the discovery rate was less than half of this. But the total X-rayed was the smallest since 1952, and it was hoped that this would be far exceeded in 1958, as a result of the Council's Mass Radiography Campaign planned in 1956. At its November, 1957, meeting the Council resolved to form a Campaign Committee to undertake the necessary work, following discussions with the County Council and the Consultant Chest Physician.

VACCINATION AND IMMUNISATION

B.C.G. Vaccination

There was an increase in the number of children eligible for protection against tuberculosis, but, as Table 14 shows, the percentage of acceptors has fallen slightly. One would like to see every possible child receive the benefit of this immunisation when approaching school-leaving age.

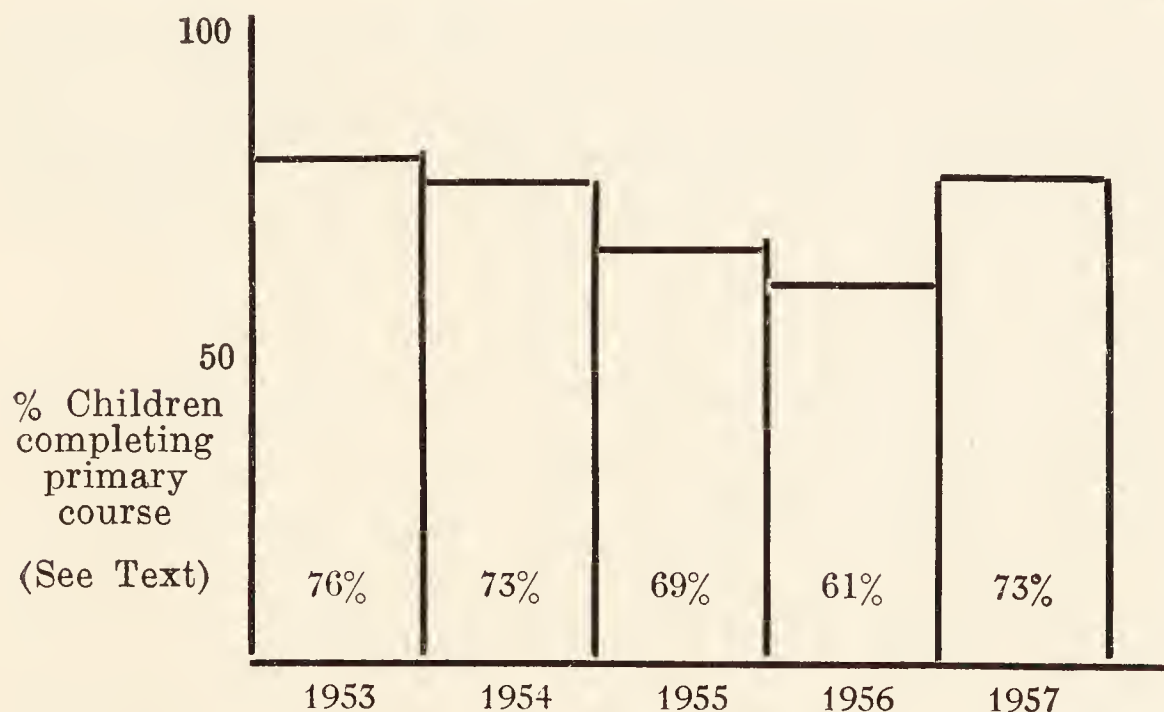
TABLE 14.

Year	No. of children eligible for test	No. & %age of parents consenting	No. tested	No. & %age Mantoux positive	No. Mantoux negative	No. given B.C.G.
1955	290	252 (87%)	244	98 (40%)	146	144
1956	297	252 (85%)	235	98 (42%)	137	137
1957	387	316 (82%)	311	114 (37%)	197	195

Diphtheria Immunisation

The decline in cases of diphtheria continues, and 1957 saw only 37 cases resulting in 4 deaths in England and Wales. But even so few deaths need not, and should not, occur.

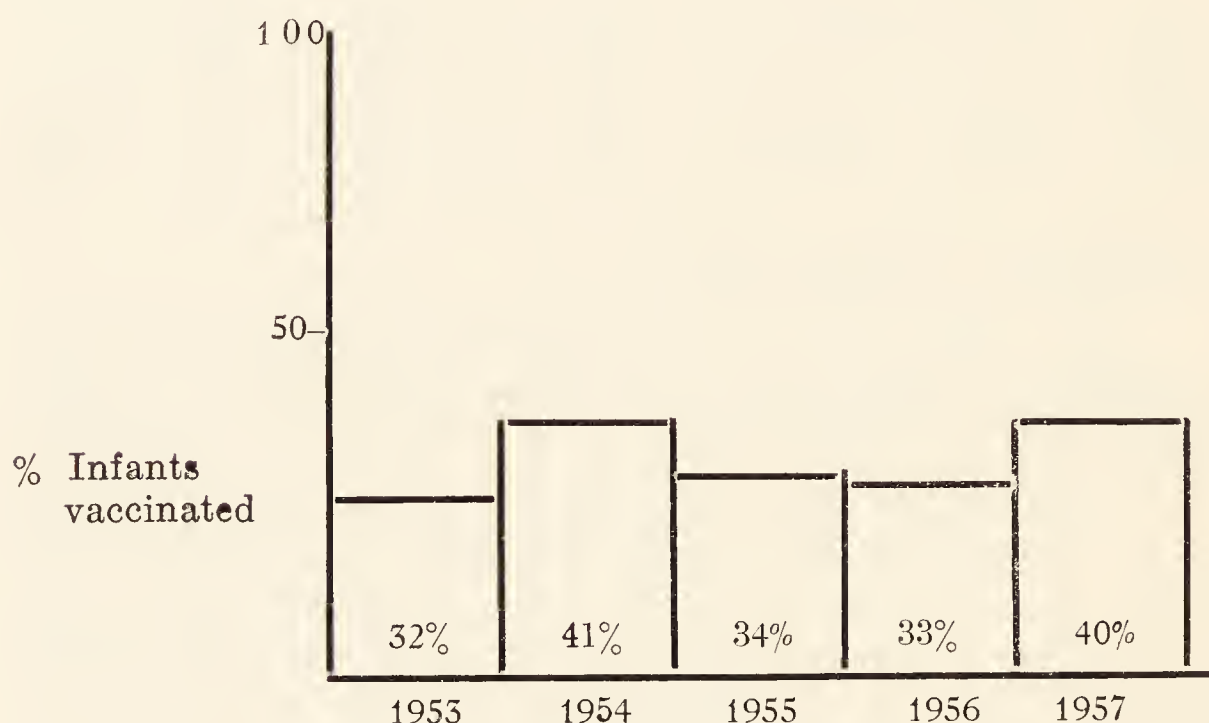
As the figure shows, the numbers of children protected against diphtheria in the Rural District increased in the year under review. It illustrates the number of children under five years of age who completed a primary course of immunisation during the year, as a percentage of the births in the previous year. The results approximate to the "diphtheria immunisation index" which for the country as a whole is some 53% only.



Smallpox Vaccination

There was a slight but welcome increase in the number of infants being vaccinated against smallpox. This cannot definitely be ascribed to the introduction of vaccination at the local health authority clinics, though this should have a beneficial effect eventually. In fact, the acceptance rate for vaccination increased throughout the country, but the national figure of 43% is not satisfactory.

Of the four cases of smallpox occurring in 1957, only the two vaccinated recovered. No further comment is necessary.



Poliomyelitis Vaccination

In the age groups eligible for immunisation, children born from 1947 to 1954, there were 3,625 registrations. Vaccine supplies during the year were sporadic and progress in giving protection fell below what was hoped for. Of the children registered, 422 (11.6%) completed a course of immunisation.

SECTION E

Radioactivity in Ennerdale Rural District

The occurrence of an accident at the Windscale Works of the United Kingdom Energy Authority in 1957 necessitates a review of both the normal radioactive hazards in Ennerdale Rural District and those arising from the accident.

There are no users of radioisotopes in the district other than the U.K.A.E.A. and all external radioactivity is natural cosmic and background radiation supplemented by fall-out from nuclear explosions, and any emission from atomic energy establishments. Of the latter, there are two, Calder Hall for the production primarily of electricity, and Windscale for the production of plutonium. There is also an advanced gas cooled reactor (AGCR) under construction, a prototype for future power stations.

To understand possible dangers it is necessary to have some idea of the working of a Windscale atomic pile. A pile consists of a large number of cartridges of uranium sealed in aluminium or zirconium cases inserted into channels in a large mass of graphite. Other cartridges may be inserted for preparation of a variety of radioisotopes used in research and industry.

Neutrons are given off by that small fraction of uranium which is naturally radioactive. Normally they would have little effect on the remainder of the uranium, but by controlling their speed they can be made to convert it to an unstable form which decays through stages to form plutonium. The graphite of the pile has a moderating effect on speed, while further control is exerted by cooling, and by cadmium rods which may be inserted into the pile to vary the reaction at will. The pile is heavily shielded so that radiation does not escape from it. It is cooled by air flowing through it at something like a ton per second, and this coolant is discharged through a 412 foot high stack to atmosphere. The stack is equipped with filters to prevent the emission of radioactive particles in the event of cartridge failure.

During the nuclear process over thirty types of fission products with a conceivable bearing on health are formed. Those of major importance are Caesium 137, Iodine 131, and Strontium 89 and 90. These accumulate in the cartridges and, after separation from the plutonium and unused uranium, must be disposed of safely. In addition, radioargon is formed by the action of neutrons on the cooling air. It has a short half-life (110 minutes) and therefore does not build up continuously in the atmosphere. Measurements of Argon 41 discharged from the BEPO stack at Harwell, which is a reactor

constructed on the same principle as the Windscale pile, have shown that the mean concentration of A.41 at ground level is less than 1% of the maximum permissible concentration (M.P.C.) for the general public. Radioargon does not constitute a hazard to health.

Radiation is of two types. It may consist of electromagnetic rays (X and gamma rays) which are very penetrating. Or it may consist of particles from fission products such as those already mentioned (alpha and beta particles are the ones which concern us here) which are much less penetrating and can travel much smaller distances, 2-10 centimetres for alpha particles, about a metre in the case of beta particles. Some of these particles give off gamma rays as well. The damage they can cause is due to their ability to produce ionisation in cells of the body, which leads to a variety of ill-effects.

The potential danger from an atomic pile is the escape of alpha, beta or gamma radiation in quantities in excess of safe levels. It has been observed that at the Windscale reactors shielding of the pile and filtering of the cooling air are designed to eliminate such danger.

During normal operation radioargon escapes, at an entirely safe concentration as has been mentioned. Other fission products are fully contained unless there is damage to a uranium can. There is then some particulate matter freed, the escape of which is made known by measuring instruments; a faulty cartridge can then be located by means of scanning gear and discharged. A fraction of the particles elude the filters, but there has never been any evidence of a discharge which approached a hazard to health.

The Windscale reactors came into operation in 1950. In 1952 there occurred in Pile No. 1 a spontaneous release of energy in the form of heat, which was due to "recovery" of the graphite from the effects of prolonged neutron bombardment. This was named Wigner energy and it was realised that it would have to be dissipated deliberately at intervals. Planned releases followed, there having been eight by the end of 1956, and in which temperatures of about 400°C. had been reached. A ninth was commenced on 7th October, 1957.

This appeared not to be proceeding, and a second nuclear heating was applied, which resulted in overheating and failure of one or more cartridges. This was indicated by increasing graphite temperature, rising activity in the pile stack meter from 8.10 a.m. on Thursday, 10th October, and the result of an air sample taken between 11 a.m. and 2 p.m. outside the Health Physics Administration Building. The last gave a result of 3,000 beta d.p.m./m³, some 13.5 times the maximum permissible level (M.P.L.) for lifetime exposure for large

populations, and considerably in excess of normal. When the affected channels in the pile were inspected the uranium cartridges were seen to be at red heat.

The 150 channels involved were not extinguished but only subdued by a series of counter-measures taken through the afternoon and night. Eventually water was turned on the pile about 9 a.m. on Friday, 11th October, and by Saturday afternoon the pile was cold. During Friday it was possible to stand down the police who had been in readiness to operate an emergency plan from soon after midnight.

In the late evening of Saturday, 12th October, I was informed by the Superintendent of Police that it was considered necessary to stop distribution of milk produced on farms within a 2 mile radius of the works. The Senior Works Medical Officer was immediately consulted, and reassurances obtained with regard to the safety of water and other supplies. There followed a discussion with the County Medical Officer on the position, the first of many with officers concerned. My notes record also talks with the Scientific Advisory Officer and the Regional Controller of the Ministry of Agriculture, Fisheries and Food, the Regional Milk Officer, the head of the Health Physics Section of the A.E.A. Industrial Group Health and Safety Branch, the Divisional Veterinary Officer, the Deputy Works General Manager and many others.

These conversations are mentioned because it was alleged after the accident that liaison with local authority medical officers was inadequate or even totally absent. That suggestion was not true so far as Ennerdale Rural District was concerned.

During the next three days the milk ban was extended to an area of some 200 square miles, roughly in a coastal strip from How Man near St. Bees southwards to the Barrow peninsula. In this period the problem of sanitary disposal of contaminated milk was agreed with the County Medical Officer; it was put out to sea not because of radioactivity, but on account of the nuisances which would have arisen out of attempting to dispose of it in or on the land. A different sort of problem arose out of the slaughtering at Whitehaven Abattoir of grazing animals from the affected area.

There was no danger from carcase meat, but the Senior Works Medical Officer had observed that the thyroid glands of these animals would contain relatively high quantities of radioactive iodine. In the circumstances it was felt preferable to ensure that these glands should not go for manufacturing purposes, but, where not required for assay or research, would be destroyed.

Accordingly the Health Department sent notices to the 132 farms in Ennerdale Rural District known to be concerned, asking that animals sent for slaughter anywhere should be notified to the Medical Officer of Health. Similar action was taken by the Medical Officer of Health for Millom Rural District. These animals were marked with yellow paint after sale to facilitate handling at the abattoir, and the fears of some farmers that their stock were being "branded" and depreciated before sale were groundless.

Restrictions on the use of milk from cows being transferred out of the area were probably needless. The move to fresh pasture, coupled with dilution through bulking of the milk with that from an unaffected herd, plus the normal discard of milk from a cow recently transported, was safety measure enough. To guard against the slight possibility that a smallholder would replace his single milker with an affected cow it was first advised that the milk from a cow sold out of the area should be discarded for twenty-four hours. Unfortunately, on 22nd October, an officer, not of the U.K.A.E.A., suggested the milk should be discarded for three days and this further restriction was passed to the police.

A protest was made from this department at the unnecessary restriction; it is believed there were others. In any event the instruction was countermanded the following day on the advice of the Medical Research Council, but not in time to prevent a stir following the sale in Devon of five cows from which milk was consumed before the "three day ban" caught up with them.

Vegetables, eggs, meat and poultry were among the many foods examined and found entirely safe for consumption, as for that matter was human milk.

The control area for milk was reduced in stages, on 31st October, 4th November and finally removed on 23rd November, 1957. It would have been safe to decontrol most of the area well within the six weeks for which controls operated, but this period ensured that there were no small pockets remaining where milk containing more than 0.1 micro-curie/litre of I 131 could be found. Altogether some 600 farms were involved and decontrolling them in short stages was administratively impossible. As it was, the Milk Marketing Board had an arduous task in collecting the milk for disposal and supplying distributors with "safe" milk without being called upon to differentiate between small groups of farms. Similar considerations applied in the case of farmers who might have been willing to "decontaminate" their herds by moving them in to winter feed. Checking that they kept their cows off pasture conscientiously would have been much too difficult,

the same distribution problems would have arisen, and there would have been unwelcome inroads into winter feeding stuffs for some farmers.

In reviewing the course of action taken, one must return to the events at the time of the accident. It was obvious on Thursday, 10th October, that radioactivity was escaping from the stack. The urgent questions were, how much and of what variety? District surveys commenced at 15.00 recorded 4 mr/hr. as the highest gamma activity. Direct radiation of the body did not therefore appear to be a danger, as a figure of 7.5 mr/hr. is permissible for continuous (occupational) exposure. Air activity was highest at 2300 hours on the Calder Farm Road and, at some ten times the permissible level for continuous lifetime breathing, did not suggest any serious threat by inhalation. Ground activity was of the order of 10^{-7} c/sq. metre up to 10^{-5} c/sq. metre, the higher figure being still only a thousandth of the level at which severe restrictions on, or even evacuation of, the general population might become necessary.

Such risk as there was would arise from the deposition of radioactive particles on the ground, leading in one way or another to contamination of food. The examination of air samples showed disproportionately high iodine activity and demonstrated that the stack filters had retained the major part of the fission products while iodine, which boils at $183^{\circ}\text{C}.$, had escaped in the form of vapour. Even this was limited by the cooling effect of the high stack, and much of the condensed iodine was retained.

Iodine consumed by the cow when grazing is excreted in the milk at a fairly fixed level; increasing the normal intake by the addition of radio-iodine leads to substitution of some of the iodine normally present by $\text{I } 131$, but not to an increase in the percentage of total iodine in the milk. There is, however, an increase of excretion via the urine, the kidneys excreting iodide at the rate of 6% per hour.

The first milk analysis available at 0300 on 12th October contained .004 micro-curie/litre; those obtained some ten and twelve hours later showed 0.48 and 0.8 micro-curie/litre respectively and indicated the necessity for the milk ban. It seems likely that samples taken much in advance of the first rated "merest trace" would also have shown harmless amounts and perhaps been misleadingly reassuring. Criticism in the White Paper of delay in sampling seems a little stringent when one considers the time required for deposition of the iodine, grazing, absorption and excretion in the milk. Furthermore, the wind on 10th October was such as to blow the fission products mainly out to sea. It has been postulated that there was, in fact, an inversion coupled with differing wind direction a few

hundred feet above the ground, causing ground contamination in a direction not anticipated when the accident took place. If this hypothesis is correct it was certainly a misfortune that such unusual meteorological conditions should have prevailed.

The radio-iodine danger comes from its affinity for the thyroid gland in which is absorbed about a third of the intake. Children were more at risk than adults as their diet contains proportionately more milk; those who were longest "at risk" could in theory have accumulated enough I 131 to give a total average dose of 25 rads. The largest dose found in a child was 16 rads, less than a tenth of the minimal toxic dose.

The Medical Research Council Committee on Health and Safety aspects gave particular attention to the emission of radiostrontium, and decided that a small but definite rise in the levels of Sr 90 in the district followed the accident. The total contamination due to the accident, previous emissions of no significant amount, and nuclear weapon test fallout, was well below that which could cause any health danger even if the milk were consumed for years.

Similarly, contamination with radioactive caesium was found to be of negligible significance to health.

It was concluded by the M.R.C. Committee that it was in the highest degree unlikely that the health of any person was harmed as a result of the accident, whether a worker at Windscale or a member of the public.

That was immensely reassuring in the face of national disquiet. Concern was proper, but not the frantic anxiety professed by some newspapers. Fortunately local people were well served by the local Press, whose accounts were factual and well balanced.

It is, however, only a half-truth to say there never was any danger. There could well have been a major disaster but for the skill, resolution and devotion to duty of the Authority's staff. Naturally there has been concern that there should be no repetition of such a possibility.

During 1958 Pile No. 1 was permanently closed down and, at the time of writing, the fate of Pile No. 2, following the report of the Technical Evaluation Committee, is undecided; though the Committee felt it could be modified to incorporate the safety lessons learnt through the accident, it is not clear whether modifications are economically justifiable. There was no doubt, however, that the time had come to review the organisation of certain parts of the U.K.A.E.A., including the control of Health and Safety. Two Fleck Committees reported in December, 1957, and concluded there were no fundamental weaknesses. Nevertheless, a large number

of recommendations were made, not least with regard to the necessity to recruit additional health and safety staff to relieve those who are at present seriously overburdened.

Medical officers of health are among those charged to acquire a knowledge of radiological hazards and methods of checking for contamination and exposure. This is part of a long term national policy concerning officers in industry, agriculture and medicine, whose responsibilities are being increased with the growing use of radioisotopes. One indication of the size of the problem is that over three hundred and fifty factories or research departments use these radioactive materials, sharing over 10,000 consignments annually.

It is true that these issues are made only to responsible users. Nevertheless there are no universal codes of practice for the avoidance of hazard, and those in existence are not yet complete. Further, mishaps which might lead to health dangers are not notifiable to any authority, and there is no legislation controlling the disposal of certain radioactive wastes other than the general safeguards embodied in the Public Health Act and river pollution enactments. A national waste disposal system has been advocated and would overcome some obvious possibilities of risk.

It has been suggested that Health Departments should undertake monitoring in their own districts, but there seems no adequate reason for local authorities to saddle themselves with schemes at once so ambitious, so costly and so unnecessary. The work is already being done, and what is required is that Councils may satisfy themselves that their responsibilities for safeguarding the public health are being discharged. In this respect a medical officer should be well placed generally to advise his Authority and undertake the necessary liaison with the staff of an A.E.A. establishment. It seems desirable also that he should be aware of all radioisotope users in his area.

Permanent closure of the Windscale Piles would not, of course, spell the end of radioactivity in Ennerdale. Disposal of wastes from the chemical separation plant will continue as hitherto under the most rigid control, eventually to sea for the most part.

The precautions taken have been published in a number of accounts and are too detailed to consider here, but it should be mentioned that possible risks from bathing, walking on the beach, eating fish or seaweed, swallowing sea-water or breathing sea-spray, and the handling of fishing gear are some of the items carefully assessed from the viewpoint of safety.

The piles at Calder Hall will continue working, and these reactors appear to be inherently safe. Operating at higher temperatures they do not acquire Wigner energy, and the cartridge channels are continuously monitored for radioactive escape. The carbon-dioxide coolant circulates in a closed circuit and when, at intervals, it is released for maintenance purposes it is filtered through ceramic filters to remove radioactive particles before discharge to atmosphere through a high stack. The reactor control rods are held in place magnetically so that in the event of power failure they are automatically dropped into the pile, so shutting it down.

The Windscale incident must rank as unique, surely the costliest accident ever to take place without injury or loss of life. At the same time, much good has emerged from a national stock-taking of what radioactivity means to us. At the time of the industrial revolution loss of life, ill-health and human misery were accepted as the inevitable concomitants of progress. It is a measure of the development of social conscience that now we deplore not only any unnecessary risk to our fellow men, but also any threat to generations unborn.

REPORT
of the
CHIEF PUBLIC HEALTH
INSPECTOR

PUBLIC HEALTH INSPECTOR'S ANNUAL REPORT, 1957

Housing

The following shows the housing position and action taken during the year:—

A	1.	Total number of occupied dwelling houses in the district	...	...	...	...	...	8,803
	2.	Total number of occupied dwelling houses subject to Demolition Orders, Closing Orders or Undertakings	...	...	...	...	...	129
	3.	Estimated number of houses (exclusive of above) which are unfit for habitation and cannot be made fit at a reasonable cost	...	...	...	...	...	1,539
	4.	Estimated number of sub-standard houses (exclusive of above) which could be repaired and made fit	...	...	...	...	...	2,367
	5.	Number of houses found to be overcrowded	...	...	...	...	...	19
B	1.	WAITING LISTS.						
		Total number of valid applicants on Council's waiting list, exclusive of those living in houses under A 2 and 3 above	...	...	...	...	...	504
C		NEW HOUSES COMPLETED DURING THE YEAR.						
	1.	By or for the Council	...	...	...	...	...	29
		For aged persons	...	...	...	...	...	nil
		For agricultural workers	...	...	...	...	...	nil
		Flats	...	...	...	...	...	nil
		General purpose houses	...	...	...	...	...	29
	2.	Private building	...	...	...	...	...	21
								—
		Total	...	...	...	...	...	50
								—
D	1.	Number of houses for which application was made by private persons for Improvement Grants under the Housing Act, 1949	...	...	...	...	...	26
	2.	Number of houses for which grants were approved	...	...	...	...	...	21
	3.	Number of houses where improvements were carried out and grants paid	...	...	...	...	...	24
	4.	Number of houses purchased or taken over by the Council with a view to improvement or conversion	...	...	...	...	...	Nil
	5.	Number of houses improved by the Council:						
		(i) With grant	...	...	...	...	...	Nil
		(ii) Without grant	...	...	...	...	...	Nil

E HOUSES DEMOLISHED.

In Clearance Areas.

	Houses De- molished	Displaced, Persons	Families
1. Houses unfit for human habitation	3	27	7
2. Houses included by reason of bad arrangement, etc.	Nil	Nil	Nil
3. Houses on land acquired under Section 43, Housing Act, 1957 ...	Nil	Nil	Nil
Not in Clearance Areas.			
4. As a result of formal or informal procedure under Section 17 (1), Housing Act, 1957	5	25	5

F UNFIT HOUSES CLOSED.

		Displaced: Number Persons	Families
1. Under Sections 16 (4), 17 (1) and 35 (1), Housing Act, 1957	5	15	3
2. Under Sections 17 (3) and 26, Housing Act, 1957	Nil	Nil	Nil
3. Parts of buildings closed under Section 18, Housing Act, 1957 ...	Nil	Nil	Nil

G UNFIT HOUSES MADE FIT AND HOUSES IN WHICH DEFECTS WERE REMEDIED.

	By Owner	By Local Authority
1. After informal action by local authority	1,030	Nil
2. After formal action under		
(a) Public Health Acts ...	11	1
(b) Sections 9 and 16, Housing Act, 1957	Nil	Nil
3. Under Section 24, Housing Act, 1957	Nil	Nil

HOUSE LETTING

The rehousing of applicants for Council houses continues to be carried out on a points system.

Inspection and Supervision of Food

(a) Milk Distributors:

Number of registered dairies	8
Number of registered distributors ...	16

(b) Sampling of Milk.

The scheme whereby the duty of the County Council of taking samples from the pasteurising plant was undertaken by the Sanitary Inspector of the area continues.

Of the twenty-five samples taken for Phosphatase and B. Coli tests from the two Pasteurising Plants all were satisfactory.

Of the twelve samples taken from distributors one was not satisfactory. Six samples for T.B. have been taken; all were negative.

(c) Food Inspections.

The following table indicates the number and type of premises in the area to which the provisions of Section 13 of the Food and Drugs Act might properly be applied:—

Premises	Number	Inspections
Butchers	20	48
Fishmongers and Poulterers	2	—
Greengrocers and Fruiterers	19	40
Grocers	126	37
Fried Fish Shops	15	1
Confectioners	32	1
Dairies	8	28
Restaurants and Food Preparing Premises	83	4
Ice Cream Premises		
(a) Manufacturers	1	6
(b) Retailers	75	5
Hotels and Inns	107	18
Bakehouses	19	9
Slaughterhouses	3	146
Street Vendors' and Hawkers' Carts	—	2

Of the above premises thirty-one are registered for the preparation or manufacture of sausages, potted, pressed, pickled or preserved food, and seventy-five for the sale of ice cream. There is one registered manufacturer of ice cream in the area and he is considered very satisfactory.

Any contraventions of the Food and Drugs Act and Food Hygiene Regulations were suitably dealt with on the spot through co-operation with the persons concerned.

Three applications for the sale of ice cream were received, all of which were granted. Five samples of ice cream were taken, all of which were in Grade I.

Condemned open food is dealt with by incineration, tinned goods are either opened and burnt or buried intact. The following table shows the amount of food condemned as unsatisfactory:—

Commodity	Weight in Pounds
Meat	850
Fish	9
Vegetables	49
Fruit	138 $\frac{1}{4}$
Eggs	28
Butter	2 $\frac{1}{2}$
Milk	4 $\frac{3}{4}$
Soups	4

(d) Slaughterhouses.

There are three slaughterhouses in the area, to which 146 visits were made.

The following table shows the number of carcasses inspected and condemned:—

CARCASSES INSPECTED AND CONDEMNED									
				Cattle excluding		Sheep and			
				Cows	Cows	Calves	Lambs	Pigs	Horses
Number killed				122	—	2	261	154	—
Number inspected				122	—	2	260	154	—
All Diseases except Tuberculosis and Cysticerci									
Whole carcasses condemned ...				1	—	2	—	1	—
Carcasses of which some part or organ was condemned				26	—	—	1	3	—
Percentage of the number inspected affected with disease other than Tuberculosis and Cysticerci				22.1	—	100	.3	2.5	—
Tuberculosis only									
Whole carcasses condemned ...				—	—	—	—	—	—
Carcasses of which some part or organ was condemned				—	—	—	—	—	—
Percentage of the number inspected affected with tuberculosis				—	—	—	—	—	—
Cysticercosis									
Carcasses of which some part or organ was condemned				—	—	—	—	—	—
Carcasses submitted to treatment by refrigeration				—	—	—	—	—	—
Generalised and totally condemned				—	—	—	—	—	—

(e) Meat Inspection.

The following table shows in tabular form diseases found other than Tuberculosis and the amount of meat affected and destroyed.

					Weight in Pounds
Abscesses					35
Bruising					25
Cirrhosis					110 $\frac{1}{4}$
Foetal Calves					50
Hydatid Cysts					$\frac{1}{4}$
Moribund					178
Odour					14
Necrosis					$\frac{1}{2}$

Shops:—

There are 319 shops in the area; no inspections were made.

Movable Dwellings:—

There are five licensed camping sites in the area and five applications to erect or station and use a movable dwelling were received and granted. Thirty-one inspections were made and no offence called for other than verbal action.

Filthy and Verminous Premises:—

Twenty-one inspections were made to fourteen houses. The method of dealing with verminous premises by supplying insecticides, instructing occupiers in their use and in general principle of hygiene continues.

Drainage and Sewerage:—

Fourteen houses were converted from the conservancy system to water carriage:—

Parish	Drained to:	
	Main Sewer	Septic Tank
Arlecdon & Frizington ...	—	I
Cleator Moor ...	—	I
Gosforth ...	—	I
Haile ...	2	I
Lamplugh ...	—	I
Lowside Quarter ...	—	2
Netherwasdale ...	—	I
Ponsonby ...	—	I
Rottington ...	—	I
St. John ...	I	I
	—	—
	3	II
	—	—

The 15in. cast iron pipe at the Cleator Sewage Works and 9in. length of sewer at Brisco Mount, Egremont, were renewed.

Sanitary Conveniences:—

New sanitary conveniences were erected in the villages of Parton and Lowca.

Refuse Collection and Disposal:—

Six refuse tips are in use within the area; these are situated at Langhorn, Bigrigg—2, Cleator Moor, Distington, Frizington and Moor Row; all of them leave much to be desired.

Private contractors employed on the collection of refuse and privy contents have continued to deal with 65 outlying properties distributed in the following parishes:—Egremont 6, Arlecdon and Frizington 45, Weddicar 4, and Moresby 10.

Water Supply

The renewal of a Distington water main was effected.

Of the sixteen samples of water, as supplied to the parishes from the various sources subject to examination by the County Analyst, one sample from Ennerdale/Wormgill (mixed supply) and two from Meadley were not regarded as satisfactory. A detailed report on the water samples taken will be found at the end of the report.

Particulars of the number of houses and the estimated population on public supplies are shown in the following table :

	No. of Houses	No. of Houses supplied from Public Water Mains:		Estimated Population Supplied
		(a) Direct	(b) Stand-pipe	
Arlecdon and Frizington	1,311	1,294	10	4,329
Cleator Moor	1,937	1,930	—	6,390
Distington	776	760	—	2,460
Egremont	2,113	2,111	—	6,213
Ennerdale and Kinniside	92	35	2	116
Gosforth	237	205	—	612
Haile	52	40	—	139
Lamplugh	221	200	2	661
Lowca	298	292	—	913
Lowside Quarter ...	130	63	—	189
Moresby	293	273	—	944
Netherwasdale	41	—	—	—
Parton	348	337	11	1,383
Ponsonby	26	23	—	81
Rottington	18	15	—	65
St. Bees	354	344	3	1,033
St. Bridget	184	154	—	764
St. John	349	344	—	1,163
Weddicar	120	103	10	457

The following table is a summary of inspections carried out not appearing in another part of the report and not calling for special consideration :—

Water Supply	533
New Drainage	146
Stables and Piggeries	11
Public Conveniences	6
Theatres and Places of Entertainment ...	1
Refuse Collection	16
Refuse Disposal	30
Building Byelaws	42
Nuisances	68
Sewerage	49
Number of Houses inspected	1,785
Number of inspections made to Houses ...	2,087
Enquiries in cases of Infectious Diseases ...	64
Visits re Disinfection	36
Miscellaneous Infectious Disease inspections	30
Miscellaneous inspections	578

FACTORIES AND WORKSHOPS

1. Inspection of Factories, Workshops and Workplaces

	Register	Inspection	Number of Written Notices	Prosecutions
(1) Factories without mechanical power	18	—	—	—
(2) Factories with mechanical power	76	17	—	—
(3) Other premises	1	—	—	—
Totals	95	17	—	—

2. Defects Found In Factories, Workshops and Workplaces

	Number of cases in which Defects were:				
	Found	Remedied	Referred to H.M. Inspector	by H.M. Inspector	Prosecutions
Want of Cleanliness ...	—	—	—	—	—
Overcrowding	—	—	—	—	—
Unreasonable Temperature ...	—	—	—	—	—
Inadequate Ventilation	—	—	—	—	—
Ineffective drainage of floors	—	—	—	—	—
Sanitary Conveniences:					
(a) Insufficient ...	—	—	—	—	—
(b) Unsuitable or Defective ...	—	—	—	—	—
(c) Not separated for Sexes ...	—	—	—	1	—
Other Offences	—	—	—	—	—
Totals	—	—	—	1	—

APPENDIX

Date	Source	Before or after Chlorination	Number of Colonies on Nutrient Agar after 72 hours		Presumptive B. Coli Test after 72 hours	Clostridium Welchii Test at 44° C. in 40 ml. after 48 hours	
			at 37° C.	20/22° C.			
23/1/57	Meadley	after	33 per ml.	81 per ml.	Negative in 90 ml.	2 large colonies	
Remarks: This sample is satisfactory in so far as the counts on Agar at both temperatures are within satisfactory limits and the probable number of coliform organisms is of the order of 1 per 100 ml. of sample, which, for a chlorinated supply, is regarded as being excessive; moreover, a disturbing factor is the development of 2 large colonies in the Clostridium Welchii test, indicating the presence of contamination from faecal sources; although it is known that the spores of this group of organisms is more resistant to the bactericidal action of chlorine than are coliform organisms. In my opinion it would be advisable to increase the dose of chlorine in the area from which the sample was drawn, and a further sample should be submitted very shortly.							
26/1/57	Owsen Fell	After	1 in 2 ml.	1 per ml.	Negative in 100 ml.	Negative	
Remarks: The sample affords no evidence of contamination by undesirable drainage and it is of good and wholesome quality for human consumption.							
2/2/57	Meadley	After	30 per ml.	55 per ml.	Positive in 100 ml. Negative in 90 ml.	Negative	
Remarks: The sample shows a distinct improvement in the Clostridium Welchii test as compared with the last sample taken at the same place and received on the 19/1/57, and although the probable number of coliform organisms is of the order of 1 per 100 ml. of sample this has no real hygienic significance and in my opinion the supply is of good and wholesome quality for human consumption.							

Date	Source	Before or after Chlorination	Number of Colonies on Nutrient Agar after 72 hours at 37° C.		Presumptive B. Coli Test after 72 hours	Clostridium Welchii Test at 44° C. in 40 ml. after 48 hours
4/3/57	Lamb Hill	Unchlorinated	6 per ml.	15 per ml.	Positive in 50 ml.	Negative
Remarks: This sample affords no evidence of pollution associated with sewage or other undesirable drainage of similar character. The fact that the probable number of coliform organisms in an untreated supply is of the order of 13 per 100 ml. of sample has no real hygienic significance since efficient chlorination would remedy the defect, so that the supply represented by the sample is one suitable for use for human consumption under proper conditions.						
18/3/57	Ennerdale Lake and Wormgill	(After) (Unchlorinated)	371 per ml.	1,798 per ml.	Positive in 30 ml.	1 medium colony
Remarks: This sample discloses a considerable degree of contamination by surface water, although there is no evidence of pollution by any drainage associated with sewage. As the sample has been taken, apparently from a mixed supply, part of which is chlorinated and part is not chlorinated, it would appear that efficient and increased chlorination will correct the defects which are apparent.						
20/3/57	Meadley	After	151 per ml.	2,268 per ml.	Positive in 20 ml.	1 large and 1 small colony

Remarks: This sample discloses a very marked degree of contamination by surface water when judged not only by the high counts at both temperatures, but also by the fact that the probable number of coliform organisms is of the order of 5 per 100 ml. of sample, which is excessive for a chlorinated supply, and the development of one large and one small colony in the Clostridium Welchii test. In my opinion the amount of chlorine should be stepped up in the treatment of this supply.

Date	Source	Before or After Chlorination	Number of Colonies on Nutrient		Presumptive B. Coli Test after 72 hours Positive in 100 ml.	Clostridium Welchii Test at 44° C. in 40 ml. after 48 hours
			Agar after 72 hours at 37° C.	20/22° C.		
18/3/57	Gosforth Springs	Unchlorinated	55 per ml.	76 per ml.	Negative in 100 ml.	Negative
Remarks: Of good and wholesome quality.						
20/3/57	Cogra Moss	Unchlorinated	3 in 2 ml.	16 per ml.	Negative in 100 ml.	1 small colony
Remarks: Although the development of one small colony in the Clostridium Welchii test may give rise to some doubt, in other respects the sample is of good and wholesome quality provided that no deterioration is likely to occur.						
9/5/57	Ennerdale Lake and Wormgill	(After) (Unchlorinated)	5 in 2 ml.	248 per ml.	Negative in 100 ml.	Negative
Remarks: This sample affords a somewhat high count on Agar at 20-22° C. for which there appears to be no explanation unless it has to do with the unchlorinated supply at Wormgill, but there is no evidence of any pollution associated with sewage or other foul drainage and therefore it is probably due to some fortuitous circumstances.						
9/5/57	Meadley	After	45 per ml.	45 per ml.	Positive in 50 ml.	Negative
Remarks: The only criticism in connection with this sample is the fact that the probable number of coliform organisms is of the order of 5 per 100 ml. of sample, which is regarded as being excessive for a chlorinated supply, but as no Residual Chlorine could be detected it is suggested that there should be an increase in the amount of chlorine introduced into this part of the supply. In other respects no possible objection could be taken to the water represented by this supply.						

Date	Source	Before or after Chlorinated	Number of Colonies on Nutrient		Presumptive B. Coli Test after 72 hours	Clostridium Welchii Test at 44° C. in 40 ml. after 48 hours
			Agar after 72 hours at 37° C.	20/22° C.		
3/6/57	Gosforth Springs	Unchlorinated	0 per ml.	1 in 2 ml.	Negative in 100 ml.	Negative
Remarks: Of good and wholesome quality.						
3/6/57	Meadley	After	29 per ml.	43 per ml.	Negative in 100 ml.	1 small colony
Remarks: The results afforded by this sample in the counts at both temperatures and the presumptive B. Coli test are perfectly satisfactory, and although 1 small colony was found to develop in the Clostridium Welchii test, this is of no hygienic significance since it is known that the spores which develop into these colonies are more resistant to chlorination than is the case with the Coliform Organisms. In my opinion no valid objection could be taken to the use of the supply as represented by this sample for human consumption.						
26/8/57	Meadley	After	4 per ml.	4 per ml.	Negative in 100 ml.	Negative
Remarks: Of good and wholesome quality.						
2/11/57	Ennerdale Lake and Wormgill	After Unchlorinated	2 per ml.	1 in 2 ml.	Negative in 100 ml.	Negative
Remarks: Of good and wholesome quality.						
8/10/57	Cold Fell	Unchlorinated	27 per ml.	3,496 per ml.	Positive in 50 ml.	Negative
Remarks: This sample affords no evidence of pollution by sewage or associated drainage, but the count on Agar at 20-22° C. is very excessive and the necessary steps should be taken to treat the supply by efficient chlorination.						

County Analyst's Office,
Darlington.

15th April, 1957.

I hereby certify that I have analysed the undermentioned sample of water marked: Sample taken at Queen's Hotel, St. Bees, 9-30 a.m., 14/4/57. Source—Meadley Reservoir (Chlorinated), Wormgill (Unchlorinated), which I received from Mr. R. Buttery, Chief Public Health Inspector, Cleator, on the 5th day of April, 1957, and that I find as follows:—

					Parts per 100,000
Chlorine as Chlorides	...	...	...	...	1.1000
Nitrogen as Nitrates	...	...	...	...	0.0872
Ammonia	...	...	...	...	0.0008
Albuminoid Ammonia	...	...	...	...	0.0043
Oxygen Absorption	...	...	...	...	0.0560
Injurious Metals	...	...	...	...	None
Total Solid Matter dried at 100° C.	...	...	...	...	4.0000
pH value of Sample	...	...	...	...	6.7
Temporary Hardness	...	None	Degrees.		
Permanent Hardness	...	1.30	„		
Residual Chlorine	...	...	...	...	None
Colour of Sample on Hazen Scale	...	...	...	...	5
Appearance of Sample in 2 foot tube	...	...	...	...	Not quite clear
Odour when heated to 50° C.	...	...	...	...	None

—Microscopical Examination

Considerable deposit from $\frac{1}{2}$ gallon consisting of earthy matter (mainly hydrated Ferric Oxide), vegetable debris, fungus growths and some micro-organisms.

The sample, when judged by the results of the chemical analysis, is of a very high order of purity and free from excessive amounts of nitrogenous constituents such as are usually associated with sewage or other undesirable drainage. There is a considerable deposit recorded under the microscopical examination which is largely hydrated Ferric Oxide and which, although of no hygienic significance, tends to give an unpleasant appearance to water drawn from this supply, consequently I should advise flushing the mains in the area from which the sample was drawn and if this is done no objection could be taken to the use of the supply for all domestic purposes.

Signed: CYRIL J. H. STOCK.

